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AMERICAN SPECIES OF *LUDIUS*; THE *CRUCIATUS* AND *EDWARDSI* GROUPS* (COLEOP.)

BY W. J. BROWN,
Ottawa, Ontario.

A recent critical study of a number of species of *Ludius* Esch. has shown that considerable confusion exists in collections of the group, due largely to lack of adequate descriptions of the various species and to the artificial nature of the classification now in use. The genus *Ludius*, as now recognized in the American literature, is not a true genus in any natural sense, but is, rather, a heterogeneous group of species the natural affinities of which are not known. For purposes of classification, the species have been grouped primarily by characters of the antennae. It can be demonstrated that this has resulted in an unnatural arrangement, for the antennae, as is well known, offer sexual and specific characters as well as characters of group significance. It can be shown by the correlation of characters that body form is of more fundamental importance in indicating the natural relationships of species.

It is my intention to present descriptions of a number of the species and to note characters of group significance. In the following notes, only the original reference to each species is noted; additional bibliography has been given by Dr. E. C. Van Dyke (1932, Proc. Cal. Ac. Sci., 4th ser., XX, 435-444). I have restricted the use of trinomials to forms that appear to be of racial significance. Antennal length has been determined by drawing the antenna along the lateral margin of the prothorax and noting the position of its tip in relation to the apex of the posterior prothoracic angle. I have studied types and other material in the Museum of Comparative Zoology, the Philadelphia Academy of Natural Sciences, and the Carnegie Museum.

cruciatus group

Here are included only the European *Ludius cruciatus* L. and its American subspecies. The closest allies of *cruciatus* appear to be the species of the *edwardsi* group from which *cruciatus* differs in lacking a supplementary stria on the apical third of the ninth interval of each elytron. On comparison it will be noted too that the posterior pronotal angles are more slender in *cruciatus* and that the metasternal process separating the middle coxae is flat, not convex as in the *edwardsi* group. In view of these characters, which together with those of the aedeagus separate *cruciatus* and *edwardsi* Horn (after Van Dyke), the latter must not be continued in the lists as a variety of the former. Moreover, all Californian specimens which I have seen referred to typical *cruciatus* should be referred to *edwardsi*; these specimens superficially resemble *cruciatus* on account of their color but agree in structure with *edwardsi*.

Comparison of series of *cruciatus* reveals characters of racial significance. The subspecies are compared in the following key and descriptive notes.

*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.

1. Male antennae more slender, segments five to ten slightly but distinctly longer than wide. Pronotum less closely punctate, the punctures well separated on the sides, at middle separated by distances equal to about twice their own diameters. Transverse black band of elytron never extended on the lateral margin to apex, the apex never blackish except on the sutural interval. Ontario and more eastern regions.....*cruciatus pulcher* Lec.
Male antennae stouter, segments five to ten as wide as long. Pronotum more closely punctate, the punctures dense on the sides, separated by distances subequal to their own diameters at middle. Dark areas of elytron frequently a little larger, the transverse band often extended on the lateral margin to apex, the elytral apex always brown or black except when the markings are reduced2
2. Pronotal punctures very close. Europe.....*cruciatus cruciatus* L.
Pronotal punctures usually a trifle less close, especially near base. Manitoba and more western regions.....*cruciatus festivus* Lec.

***Ludius cruciatus pulcher* Lec.**

Corymbites pulcher Lec., 1853, Trans. Am. Philos. Soc. X, 440.

Length 10.2-14 mm.; width 3.5-5 mm.; the largest examples usually females. Body moderately convex. Head black, the frontal margin near the antennal bases red. Pronotum black, with a sublateral red vitta extending from base to apex on each side; each vitta sometimes as wide as and sometimes only half as wide as the black discal area; rarely with the discal area and the head suffused with red; scutellum black. Elytron yellow, with a sutural, a humeral and a transverse vitta blackish; the sutural vitta extending from base to apex on the sutural interval, usually extending over the second interval in basal fifth; the humeral vitta usually occupying three intervals and extending from base at the umbone over the basal two-fifths of elytron, never joining the transverse vitta; the latter situated at apical two-fifths, subequal in width to the humeral vitta, arcuate but never produced posteriorly along the lateral margin, sometimes reduced and rarely evident only as a small, median spot. Venter black; each propleuron with a red median vitta, rarely interrupted, extending from base to apex; abdomen margined with red, usually broadly so, rarely entirely red. Antennae brown; legs red or reddish brown.

Vestiture consisting of silvery, very fine, short, sparse hairs; scarcely evident dorsally except on the scutellum, more distinct on the venter; the hairs longer, very close, and conspicuous on the scutellum.

Male antenna just attaining the apex of the posterior pronotal angle; the third segment twice as long as wide, slightly wider than and twice as long as the second, two-thirds as wide as and equal in length to the fourth; segments four to ten triangular, the fourth a trifle longer than the fifth; segments five to ten subequal in length and three-fourths as wide as long; the apical segment twice as long as wide. Female antenna failing to attain the apex of the angle by a distance equal to the length of two segments, otherwise as in the male.

Head half as wide as the pronotum, closely moderately coarsely punctate; the front feebly depressed. Pronotum as long as wide in the male, a trifle wider in the female, slightly wider at the base than at the apex; the sides moderately to rather strongly arcuate; the posterior angles moderately produced and diver-

gent, strongly carinate; disk moderately coarsely punctate; the punctures separated by distances subequal to their own diameters on the sides, twice as distant at middle, a trifle finer and sparser on the posterior declivity. Elytra slightly widened to apical two-fifths and there slightly wider than the pronotum; the striae moderately impressed, rather finely punctate; intervals moderately convex, finely and very sparsely punctate.

Prosternal sutures not excavated; posterior prothoracic angle, viewed from beneath, parallel before the apex. Punctures of prothoracic venter equal in size to but closer than those of the pronotum; the propleura usually very finely alutaceous. Metasternum and abdomen finely, moderately closely punctate.

Aedeagus as figured, the lateral lobes stouter than in *edwardsi*, the median lobe not surpassing the apices of the lateral lobes.

Described from New Hampshire; the specimen bearing the name label in the Leconte collection is evidently the type. This subspecies is represented in the collection before me by forty-six specimens from the following localities: Mt. Washington, N. H.; Cheticamp, Smith's Cove, Weymouth, Kings Co., and Hants Co., N. S.; Bathurst, Grand Manan, and French Lake, N. B.; Cascapedia, Knowlton, Wright, Ft. Coulonge, and Hemmingford, Que.; Ottawa, Sudbury, Biscotasing, Miners Bay, Mer Bleue, and Hastings Co., Ont.

***Ludius cruciatus festivus* Lec.**

Corymbites festivus Lec., 1857. Rept. Expl. and Surv. Miss. to Pac. XII, pt. 3, 46.

Male antenna usually failing to reach the apex of posterior, pronotal angle by a distance equal to one or one and one-half segments; segments five to ten relatively wider than in *pulcher*, as wide as long; terminal segment stouter, two-thirds as wide as long. Female antennal segments a trifle less robust, essentially as in *pulcher*. Transverse black vitta of elytron frequently extended along lateral margin to apex, the extreme apex brownish or black except when the transverse vitta is reduced; the latter completely lacking in one example, joined to the humeral vitta in two specimens. Pronotal puncturation, except rarely, closer than in *pulcher*, the punctures separated by distances subequal to their own diameters at middle, dense on the sides, usually finer and less close on the posterior declivity. Other characters as in *pulcher*.

Described from Steilacoom, Wash.; the specimen bearing the name label in the Leconte collection, labeled as having been taken in Oregon by Gibbs, is evidently the type. Represented in the collection at hand by twenty-three specimens from Treesbank, Aweme, and Wawanesa, Man.; Bulyea, Sask.; Calgary, Waterton Lakes, Red Deer River, and Crow's Nest Pass, Alta; Nicola, Vancouver, Victoria, Nanaimo, Salmon Arm, Mt. Cheam, Saanich, Muir Creek, Vernon, Similkameen River, and Merritt, B. C.

The only character separating *festivus* from typical *cruciatus* is very feeble and is not constant; the subspecies seems scarcely worthy of a name. Typical *cruciatus* L. is represented in the collection before me by eleven specimens from Germany.

***edwardsi* group**

The species of this group differ from all others of the genus in possessing a supplementary stria, punctate and impressed like the other striae, on the apical

third of the ninth interval of each elytron. In addition to this, they possess the following characters in common:

Body just three times as long as wide; moderately convex; body hairs silvery, very fine, short, and sparse, scarcely evident dorsally except on the scutellum, more distinct on the venter; the hairs longer, very close, and conspicuous on the scutellum. Head half as wide as the pronotum except in *sexualis*. The pronotum as long as wide in the male, a trifle wider than long in the female; the sides moderately to rather strongly arcuate; the posterior angles moderately produced and divergent, not slender, parallel or almost so near the apex when viewed from beneath. Elytra slightly wider than the pronotum, subparallel or very feebly widened to apical two-fifths; striae well impressed, not coarsely punctate; intervals moderately convex. Prosternal sutures not excavated. Metasternal process separating the middle coxae somewhat convex, never perfectly flat as in *cruciatus*.

The supplementary stria of the elytron joins at its extremities the ninth stria. Rarely in *morulus* and more frequently in *sexualis*, due to lack of strong punctures on the apical portion of the ninth stria, the supplementary appears as the apical portion of the ninth. However, the ninth stria occupies the gutter which limits internally the reflexed margin of the elytron. The supplementary stria occurs within the gutter on the lateral declivity of the elytron.

As noted above, the species of this group are allied to *cruciatus*. Several show great variation in color. They are divisible by important characters as indicated in the first couplet of the following key:

1. Third antennal segment equal to or longer than the fourth, the segments triangular in form. Abdominal apex not modified.....2
- Third antennal segment shorter than the fourth; the segments beyond the fifth subparallel in the male. Apical abdominal segment with an arcuate carina and brush of hairs in the male, feebly modified in the female.....4
2. Basal half of pronotum very finely and sparsely punctate.....3
- Basal half of pronotum moderately coarsely and closely punctate.....
-*edwardsi* Horn
3. Each elytron bimaculate with yellow.....*suckleyi suckleyi* Lec.
- Elytra immaculate*suckleyi olympiae* Van Dyke
4. Length 11 to 16 mm.; black or bicolored.....*morulus* Lec.
- Length 7 to 8.3 mm.; brown or reddish-brown.....*sexualis* n. sp.

***Ludius edwardsi* Horn.**

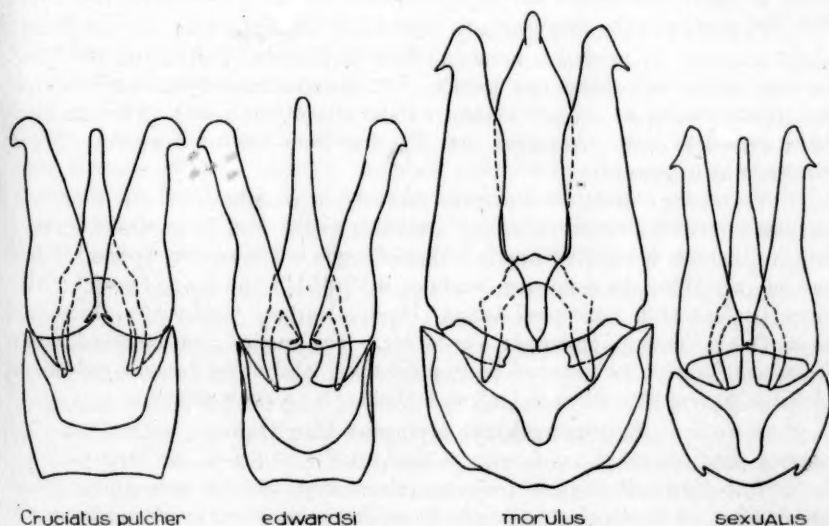
Corymbites cruciatus edwardsi Horn, 1871, Trans. Am. Ent. Soc. III, 324.

Ludius cruciatus ater Van Dyke, 1932, Proc. Cal. Ac. Sci., 4th ser., XX, 430 (nec *ater* Cand., 1864, Elater, nouv. I, 55).

Length 11-17 mm., the largest specimens usually females. Color extremely variable; antennae and legs always dark brown or reddish-brown; head, proster-num, and abdomen always black; prothorax frequently entirely black, the entire body then always black (*ater* Van Dyke); pronotum frequently black with the sides broadly margined with red, the red margin rarely not attaining the apex and only rarely including the posterior angles, the propleura then always red and the elytra entirely black or variously maculate with reddish-yellow, the elytral maculation consisting of a narrow spot or short vitta on lateral margin at base (typical *edwardsi*), or such a vitta and a subapical spot on each elytron, or with the yel-

low areas extended so that only the sutural interval, an elongate humeral spot, a transverse vitta at apical two-fifths, and the extreme apex remain black.

Antenna in the male just attaining the apex of the posterior pronotal angle; the third segment subequal in width to and about twice as long as the second, two fifths as wide as long, two-thirds as wide as and a trifle longer than the fourth; the latter subequal in length to the fifth; segments five to ten subequal, usually two-thirds as wide as long and with the terminal segment twice as long as wide, rarely with these segments not longer than wide, the terminal then shorter. Female antenna failing to attain the apex of the angle by a distance equal to the length of one and one-half segments, otherwise as in the male. Head closely, moderately coarsely punctate; front flat. Punctuation of the entire body much as in *cruciatus festinus* Lec.; the pronotal punctures moderately coarse, quite close at middle, dense on the sides, finer and less close near base; the punctures of the elytral intervals rather fine, sparse; punctures of prothoracic venter moderately coarse, close on the sternum, dense on the pleura, the latter not alutaceous; metasternum and abdomen more finely, moderately closely punctate.



Aedeagus as figured; not differing from that of *suckleyi*.

The palest examples described above closely resemble *cruciatus* in color and are generally confused with the latter in collections. I have of this form, besides a single specimen from Riverton, Calif. (3000 ft.), five specimens from the Horn collection taken in western Nevada. The Horn series includes also three specimens intermediate between this form and typical *edwardsi*, two specimens of typical *edwardsi*, and two which, by the color of the prothorax, are intermediate between typical *edwardsi* and *ater*. I have both typical *edwardsi* and *ater* from Pacific, Eldorado Co., Calif. In view of this distribution, it seems evident that the forms discussed above are mere color variants and that color

is not of racial significance. A new name is therefore unnecessary for the homonym *ater* Van Dyke which was described from Red Mt., Nevada Co., Calif. No locality data is given in the original description of *edwardsi*, and I was unable to identify the type specimen in the Horn material. However, there can be no doubt about the identity of the species as no other fits Horn's description. Thirty-five specimens of the species are before me; in addition to those noted above, the following Californian localities are represented: Tulare Co., 6400 ft.; Nr. Whitehill, Eldorado Co.; Yosemite, 4000 ft.; Round Mdw., Giant Forest; Sequoia Natl. Park, 9000 ft.; Tuolumne Co., 6400 ft.; Sand Flat, 5500 ft.; Meyers, 6300 ft.

Ludius suckleyi suckleyi Lec.

Corymbites suckleyi Lec., 1857, Rept. Expl. and Surv. Miss. to Pac. XII, pt. 3, 46.

Length 13-19 mm. A trifle more strongly shining than *edwardsi*. Black; each elytron with a lunule extending from lateral margin at the humeral umbone to middle near the suture and with a post median, more or less transverse spot yellow, the latter never joining the margins; the lunule never joining the suture, sometimes interrupted at about the sixth interval; the spots usually large, only rarely strongly reduced and then quite distinct.

Pronotum moderately coarsely and closely punctate near the apical and lateral margins, the punctures becoming finer and sparser posteriorly, very fine and very sparse on the posterior declivity. Punctures of the elytral intervals fine and sparse, sometimes scarcely evident. Punctures of the venter as in *edwardsi* but a trifle less close. Aedeagus not differing from that of *edwardsi*. Other characters as in *edwardsi*.

The species differs from *edwardsi* only in sculpture and in color. It occupies a restricted range, occurring, according to Dr. Van Dyke, from western British Columbia to the Willamette Valley, Oregon. The seventy specimens before me are from the following localities in British Columbia: Saanich; Mt. Newton; Bear Hill, Vancouver Island; Pender Harbor; Goldstream; Victoria; Royal Oak; Sidney; Courtenay; Vancouver. The species was described from Steilacoom, Wash.; the specimen bearing the name label in the Leconte collection, labeled as having been taken in Oregon by Gibbs, is evidently the type.

Ludius suckleyi olympiae Van Dyke.

Ludius suckleyi olympiae Van Dyke, 1932, Proc. Cal. Ac. Sci., 4th series, XX, 431.

This subspecies differs from typical *suckleyi* only in having the elytra entirely black. I have a single specimen from Oregon and have seen three similarly labeled specimens in the Ulke collection. Its type locality is Olympia, Wash., which is not distant from the type locality of *suckleyi*. However, the constancy of the maculation in British Columbia specimens of *suckleyi* seems to indicate that the color difference is of racial significance.

Ludius morulus Lec.

Corymbites morulus Lec., 1863, Smiths. Misc. Coll. No. 167, 85.

Corymbites brunnipes Bland, 1864, Proc. Ent. Soc. Phila. III, 67.

Length 11.5-16 mm. Antennae and legs dark brown or blackish; body back, usually entirely so; rarely with the pronotal sides in front of the posterior angles and the propleura red; rarely with the pronotum broadly and completely margined on each side with pale red, the elytra then pale reddish-yellow, the

humeral umbone and sutural interval of each usually brownish, the head, appendages, and venter except the propleura remaining black.

Male antenna surpassing the apex of the posterior pronotal angle by a distance equal to the length of two and one-third segments; the third segment twice as long as and slightly wider than the second, twice as long as wide, three-fourths as long as and three-fourths as wide as the fourth, the latter triangular and a trifle longer than the fifth; segments five to ten equal in length, each feebly widened apically but subparallel in form; the sixth segment two-thirds and the apical segment one-third as wide as long. Female antenna failing to attain the apex of the angle by a distance equal to the length of the terminal segment; the proportions of the four basal segments as in the male, segments five to ten slightly less elongate and triangular in form, the fifth equal in length to the third, the sixth seven-tenths and the apical two-fifths as wide as long.

Head very closely, moderately coarsely punctate, the front broadly and moderately concave. Pronotal punctures moderately coarse, close at middle and at base, dense on the sides; elytral intervals rather finely, not closely punctate; punctures of prothoracic venter moderately coarse, rather close on the sternum; closer or dense on the propleura, the latter not alutaceous; metasternum and abdomen finely, moderately closely punctate.

Apical abdominal segment very broadly and feebly rounded at apex; in the male the apical third of the segment supplied with an arcuate carina; the carina joining the margin on each side just before the apex, feeble at middle but strongly elevated laterally, supplied posteriorly with long, densely placed hairs; in the female the segment feebly timid at the margin on each side just before the apex, the tumidities supplied with a few moderately long, closely placed hairs. Aedeagus as figured, the basal piece very strongly concave.

This species and *sexualis* differ from all other American species in possessing the abdominal sexual structures described above. In these species, too, the basal piece of the aedeagus is much more concave than in any other American species known to me. They are evidently closely allied to the Siberian *spretus* Mann. in which, according to Candeze, the abdomen is similarly modified. The present species, common in the mountains of western Canada, was originally described from the North Red River, and the type is evidently the male specimen bearing the name label in the Leconte collection, which is also labeled to indicate that it came from the western states. Dr. Van Dyke (1932, Proc. Ac. Cal. Sci., 4th ser., XX, 441) has, without comment, listed *brunnipes* Bland as a variety of *morulus*. I have examined the cotypes of *brunnipes*, which are from Nebraska, and can not find that they differ from *morulus*. Neither have I been able to observe the metallic tinge attributed to the elytra of the species by Horn (1871, Trans. Am. Ent. Soc. III, 324).

Bicolored individuals of *morulus* are quite rare. The collection at hand includes two specimens in which the prothorax is bicolored and four in which the elytra, as well as the prothoracic sides, are pale. In each case numerous black specimens from the same localities are included in the series. The series before me contain eighty-two specimens from the following localities: Banff, Waterton Lakes, and Crow's Nest Pass, Alta.; Copper Mt., Creston, Trinity Valley,

Salmon Arm, Vernon, Summerland, Nicola, Cranbrook, Terrace, Sicamous, and Aspen Grove, B. C.; Yukon Crossing and near Selkirk, Y. T.; Eagle, Alaska; Mt. Hood, Ore. I have seen a specimen in the collection of Mr. H. C. Fall labeled Nipigon, Ont.

Ludius sexualis n. sp.

Male. Length 7.2 mm. Entire body and appendages reddish brown. Male antenna surpassing the apex of the posterior pronotal angle by a distance equal to the length of one and one-half segments; second segment two-thirds as long as and almost as wide as the third; the latter three-fourths as wide as long, two-thirds as long as and three-fourths as wide as the fourth; segments four to ten equal in length, the fourth triangular, the others sub-parallel; the sixth segment three-fourths and the apical segment two-fifths as wide as long.

Head two-thirds as wide as the pronotum; moderately coarsely, closely punctate; front broadly, not strongly concave. Pronotum with the sides not strongly arcuate, moderately coarsely punctate, the punctures close on the sides, somewhat less close at middle; elytral intervals rather finely, not closely punctate; punctures of the venter close, moderately coarse on the prothorax, fine on the metasternum and abdomen.

Apical abdominal segment as in *morulus* but with the carina well elevated at middle. Aedeagus as figured.

Female. Length 7.8 mm. Antenna failing to attain the apex of the posterior pronotal angle by a distance equal to the length of five segments; the form and proportions of the four basal segments as in the male; segments five to ten shorter and strongly triangular, the fifth equal in length to the third, the sixth equal in length and width, the apical segment two-thirds as wide as long. Apical abdominal segment as in *morulus* but with the tumidities more strongly developed and very distinct, and with the space between them distinctly tumid.

Holotype—♂, Dundurn, Sask., April 23, 1923, (K. M. King); No. 3841 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—1 ♂, same data; 4 ♂, Saskatoon, Sask., May 2 and 5, 1924, and 1925, April 28, 1926, October 27, 1928, (K. M. King); 1 ♂, Medicine Hat, Alta., April 23, 1923, (F. S. Carr); 1 ♂, Laramie, Wyo.

The paratypes vary from 7 to 8.5 in length. As in *morulus*, the abdominal sexual modifications are developed to an equal degree in all specimens. The species is frequently labeled *fuscus* Lec. in collections.

NEW COLEOPTERA FROM WESTERN CANADA. V.*

BY RALPH HOPPING,

Vernon, B. C.

Phymatodes elongatus n. sp.

Length 5-6 mm. A slender elongate species, head and body piceous with testaceous prothorax, medianally black on the pronotum and ventrally testaceous to black, the elytra dark brown and faintly shining. The head is rather finely,

*Contribution from the Division of Forest Insects, Entomological Branch, Dept. of Agric., Ottawa.

sparsely punctured, the antennae slender, piceous to brown, with the third segment $2\frac{1}{2}$ to 3 times the length of the second and longer than the fourth, extending to approximately the middle of the elytra. The front of the head has two quite pronounced transverse carinae, one between the antennae and the other just above the labrum, which latter is testaceous.

The pronotum is slightly wider than long, with a median, longitudinal black area, rather sparsely punctured on the disc, closer laterally and slightly coarser on the apex, convex and generally depressed at the base.

The elytra are at least four times as long as wide, parallel, brown, rather closely, coarsely punctured with short, semi-erect golden vestiture, and apices rather evenly rounded.

The legs are a light brown except the inflated portion of the femora which is black. There seems to be no difference in the external appearance of the sexes. In a series of twelve bred from *Abies lasiocarpa* Nutt. there is no variation in colour. One specimen was bred from *Picea engelmanni* Engel., which would indicate that fir is not the only host.

Holotype—Female, No. 3860 in the Canadian National Collection, bears the label 17426—Lot 19, Stanley, B. C., July 21, 1932, from *Abies lasiocarpa*.

Paratypes—11 from Stanley, B. C. all from the same host.

A specimen, evidently of this species, has been in the author's collection since July, 1909, taken at Huckleberry Meadow near Grant National Park, California, by the author, has been labelled "n. sp." for many years, but was never described as it remained so long the only specimen known. *P. elongatus* should come immediately after *P. densipennis* Csy. It is, however, a much more slender species, has not the pitch black colour of *densipennis* nor the stout antennae of that species.

Phymatodes densipennis Csy.

Very large series of this species have been bred from *Pinus ponderosa* Laws. Typical specimens have been compared with Casey's type. There are many colour variations, the pronotum being rufous, rufous with black median area and wholly black. These wholly black specimens are not varieties nor subspecies and do not deserve a name as all the colour variations can be found in a series bred from the same log.

Phymatodes nitidus Lec.

The remarks above apply to this species. British Columbia specimens generally have the elytra wholly black, although typical specimens are not uncommon.

Phymatodes vulneratus Lec.

For the same reasons the variety *nigrescens* Hardy & Preece should be suppressed, it is not a subspecies but only a common colour variation.

ADDITIONAL NOTES ON *TROPAEA LUNA*.

BY HARRIET WICKWIRE AND ADELE CALALE,
Cortland, New York.

The 1933 experiment in hybridizing *Tropaea luna* with *Actias selene* closed in the following manner:

Cocoons of *Actias selene*, formed in August, hatched in September, and the moths mated. A second brood of larvae was reared on rose leaves (purchased wholesale after the winter set in) but, owing to the difficulty of keeping this food supply fresh, the disease called Flatclery claimed all of the brood except one larva. The single cocoon, spun in December, gave us a female the following June, but this moth refused to mate with males of *Tropaea luna*.

From three hybrid cocoons, spun August, 1933, two male moths emerged in September. The first male emerged in cramped quarters and was discovered too late for full development. This moth was remarkable because it showed red scaling on all the veins of its wings. We wonder if it represents a reversion approaching *Graellsia isabella*. The second male developed fully and showed *selene* markings, but it was shaped like *luna*. It mated with a female of *Actias selene*, but the eggs never hatched. The third cocoon never hatched.

A course in Genetics was taken during 1934 and through this knowledge we realized an incorrect statement that we made in a previous article. We said that the striped form of *Tropaea luna* was recessive. It shows all indications of dominance, in spite of the wider distribution, and more common occurrence of the unstriped form.

Last summer's work leads us to believe that the mutation affects only one pair of factors. We obtained several broods which showed an almost perfect one to one ratio. This ratio is expected when a hybrid dominant recessive individual is crossed with a pure recessive. We also obtained one complete brood of striped larvae which required one of the following parental combinations: first, pure dominant crossed with pure recessive; second, pure dominant with pure dominant; and third, pure dominant with dominant recessive hybrid. All three alternatives presuppose the survival to maturity of a pure dominant form, so we expect to obtain a three to one ratio in the near future.

The bar on the first three abdominal segments in first instar larvae of *Actias selene* is similar in position to that on the first abdominal segment in *Tropaea luna* striped larvae. According to A. S. Packard, the larvae of *Graellsia isabella* have bands on all the abdominal segments (none are mentioned on the thorax). Can it be that the striped form of *Tropaea luna* is vestigial, a vanishing reminiscence of relationship with others of its group? If so, we wonder if a study of the geographical distribution of these striped larvae could throw light on the avenues by which the tailed attacine species entered this continent.

A SHORT REVIEW OF THE NORTH AMERICAN SPECIES OF PSEUDISTER (COLEOPTERA, HISTERIDAE).

BY HOWARD E. HINTON,
Cambridge, England.

While determining a collection of interesting Histeridae taken by the writer and others in Mexico during the past few years, three species were found to belong to the genus *Pseudister* Bickhardt. As two of these were undescribed, and as one species described from New York and one from Paraguay have been masquerading for many years under a different genus, the following short review is necessary to straighten out the existing confusion. Through the kindness of Dr. K. G. Blair and Dr. H. Scott of the British Museum, types of all the species considered in this paper have been examined by the writer.

Pseudister Bickhardt.

Pseudister Bickhardt, Gen. Ins. Fasc. 166b, p. 164, 165, 1917.

In 1917 Bickhardt erected the genus *Pseudister* to include nine American and five Indo-Malayan species. At the time, he gave a key to the American species. Since then only one, *P. latimarginatus* Bickhardt (1920), has been added to the American list of species. *Pseudister* includes those species which as a group differ only from *Epierus* in the possession of an apical, or lateral stria, or both on the pronotum, and from *Phelister* in having the anterior margin of the mesosternum emarginate instead of truncate or bisinuate.

In this paper the striae are counted from the suture outwards; and the seventh is the humeral, and the eighth is the outer humeral. The following table will serve to separate the American species:

A KEY TO THE AMERICAN SPECIES OF PSEUDISTER.

1. Humeral stria present 2
- Humeral stria absent 6
2. Humeral stria nearly complete 3
- Humeral stria short, present on only apical one-half of elytra 5
3. Sutural and outer humeral absent. Chili.....*impressifrons* Schmidt, 1849
- Sutural and outer humeral present 4
4. Outer humeral short, second stria absent, prosternal stria diverging caudally and anteriorly. Brazil*riouka* Mars., 1861
- Outer humeral nearly complete, second present, prosternal stria converging anteriorly. Brazil*kerka* Mars., 1870
5. Third extending only to the middle, outer humeral present only near apex; species feebly convex, nearly parallel. Columbia.....
-*subdepressus* Schmidt, 1889
- Third and outer humeral nearly complete; shortly oval species. Brazil....
-*sejunctus* Schmidt, 1896
6. Outer humeral complete..... 7
- Outer humeral short 10
7. Sutural complete. Brazil*suturalis* Schmidt, 1896
- Sutural not complete 8
8. Apical stria absent. Mexico*rufulus* Lewis, 1888
- Apical stria present 9
9. Third stria complete; marginal stria of mesosternum present only at sides

- of emargination. Mexico *propygidialis* sp. n.
- Third stria present only in apical one-half; marginal stria of mesosternum complete in front. Paraguay..... *pygidialis* Lewis, 1908
10. Lateral pronotal stria absent. Guatemala, Mexico..... *dubius* Lewis, 1888
- Lateral stria present 11
11. Lateral stria strongly sinuate, widely separated from lateral margin. Argentine *latemarginatus* Bickh., 1920
- Lateral stria at most feebly sinuate, approximate to lateral margin..... 12
12. With only three complete dorsal striae, third extending only to middle. Brazil *distractus* Schmidt, 1896
- With four complete dorsal stria..... 13
13. Marginal stria of mesosternum present only at sides of emarginations; propygidium moderately coarsely and densely punctate, with the punctures separated mostly by much more than their own diameters. Mexico.....
- *striatifrons* sp. n.
- Marginal stria of mesosternum complete in front; propygidium coarsely and densely punctate, the punctures separately mostly by less than their own diameters. New York..... *hospes* Lewis, 1902

***Pseudister rufulus* Lewis.**

Epierus rufulus Lewis, Biol. Centr.-Amer. Col. II, 1, p. 208, t. 5, f. 18, 1888.

Epierus rufulus Lewis, Ann. Mag. Nat. Hist. (6), Vol. 3, p. 281, 1889.

Epierus rufulus Bickhardt, Col. Cat. Pt. 24, p. 58, 1910.

Pseudister rufulus Bickhardt, Gen. Insc. Fasc. 166b., t. 8, f. 74, 74a, p. 165, 1917.

This species is probably the commonest of the genus. It has been taken commonly in Mexico and Central America in the deposits of waste material near the nests of the various species of leaf-cutting ants of the genus *Atta* by many collectors including the writer. It is the species selected by Bickhardt as the type of *Pseudister*. In addition to the characters given in the key, the following brief description will be of aid in recognizing the species easily:

Length, 3 mm. Broadly oval, convex, rufo-piceous, shining; antennal club somewhat testaceous, antennae, mouth-parts and legs paler rufo-piceous. Head with frontal stria well impressed, joined to supra-orbital striae at sides. Pronotum without apical stria; lateral stria curved anteriorly for a short distance. Elytra with humeral stria absent, outer humeral complete, sutural extending to basal two-thirds, second to basal one-half. Propygidium coarsely, moderately sparsely and finely, sparsely punctate. Prosternum moderately wide between striae, striae diverging caudally, nearly parallel anteriorly and joined in a moderate arch, not attaining lobe; mesosternum broadly, deeply, arcuately emarginate in front, marginal stria complete in front.

***Pseudister propygidialis* n. sp.**

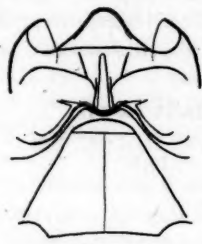
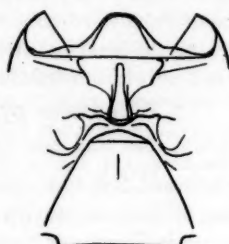
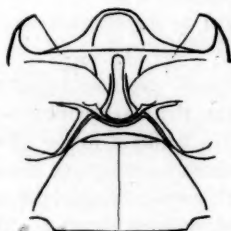
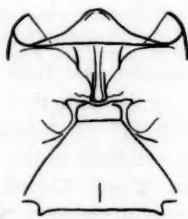
(Fig.)

Oblong oval, moderately convex, dark rufo-piceous, shining; antennae, mouth-parts and legs slightly paler.

Head with frontal stria well impressed, joining supra-orbital striae at sides, front slightly concave, sparsely microscopically punctate.

Prothorax one-third wider than long, apical marginal line not present on middle two-thirds of apex, lateral fine; apical stria straight, short, present only on middle one-third of pronotum, lateral striae complete, moderately distant from marginal line, curved at apex and extending one-fourth the distance

across the apex; sides feebly arcuate, converging moderately towards apex; base evenly arcuate; surface extremely finely punctate, nearly smooth, but with a small area at sides densely punctate with coarse, elongate punctures.

*dubius**propygidialis**rufulus**striatiformis*

Elytra about one-third longer than prothorax, apparently impunctate but sparsely, microscopically punctate throughout; striae deeply impressed, outer three nearly impunctate, inner three coarsely, crenately punctate, sutural stria extends from near apex to basal one-fourth, diverges slightly from suture and is coarser basally, second present only in apical one-third, third to sixth extending from near apex to near base and suddenly widened for a very short distance near base, at base on each side of scutellum is a very short stria; humeral absent, outer humeral complete; scutellum moderate, equilateral. Propygidium as long as pygidium, very coarsely, densely punctate, with extremely fine punctures sparsely intermixed; pygidium with a deeply impressed marginal stria at apex, coarsely, moderately densely punctate, with fine punctures densely intermixed.

Prosternum nearly flat between striae, striae converging anteriorly and joining in a narrow arch, not quite attaining lobe; carinae in front of anterior coxae diagonal, sinuate, nearly attaining lobe; mesosternum broadly, feebly, arcuately emarginate in front, apparently impunctate, marginal stria in front present only at sides, anterior portion elevated and limited posteriorly by a deeply, broadly arcuate line; metasternum and first ventral segment only sparsely, microscopically punctate, second to fourth ventral segments at middle with a single row of coarse, closely placed punctures on apical margins, more densely, irregularly punctate at sides. Length, 3 mm.; breadth, 1.8 mm.

Female: Larger, more coarsely punctate throughout; punctures on propygidium somewhat ocellated.

Type: Male deposited in the collection of the writer. Cuernavaca, Estado de Morelos, Mexico, June, 1934 (H. E. Hinton).

Paratype: Female with same data as above.

This species is most closely related to *P. pygidialis* Lewis from Paraguay, but it differs in having the third stria complete instead of present only in apical one-half, and in having the marginal stria of the mesosternum only at the sides of the emargination instead of complete in front.

***Pseudister pygidialis* Lewis.**

Phelister pygidialis Lewis, Ann. Mag. Nat. Hist. (8), II, p. 157, 1908.

Phelister pygidialis Bickhardt, Col. Cat. pt. 24, p. 31, 1910.

Phelister pygidialis Bickhardt, Gen. Insc. Fasc. 166b, p. 210, 219, 1917.

Examination of the unique type of this species shows that the mesosternum is emarginate in front, and that there are lateral striae on the pronotum. These characters place it in *Pseudister* and not *Phelister*.

***Pseudister dubius* Lewis.**

Epierus dubius Lewis, Biol. Centr.-Amer. Col., II, 1, p. 208, 1888.

Epierus dubius Bickhardt, Col. Cat. pt. 24, p. 57, 1910.

Pseudister dubius Bickhardt, Gen. Insc. Fasc. 166b, p. 164, 165, 1917.

This species was described from a unique specimen collected in Guatemala. A second specimen is in the collection of the British Museum bearing the label: Teapa, Tabasco, Mexico (H. H. Smith). In addition to the characters given in the key, the following will help future workers to recognize it easily:

Length, 1.8 mm. Small, oblong oval, convex, finely punctate throughout, pale rufo-piceous, strongly shining. Head without frontal stria, supra-orbital stria short but distinct. Pronotum with the apical stria present on middle one-half, with the ends turned at right angles and extending posteriorly to basal one-third; lateral striae absent. Elytra with the sutural stria extending from near apex to basal one-fourth, second to basal one-third; humeral absent, outer humeral present in apical one-half. Propygidium with moderately coarse and fine punctures moderately densely intermixed. Prosternum moderately wide between striae, striae diverging caudally, nearly parallel anteriorly and joined in a narrow arch, not attaining lobe; mesosternum elevated and limited posteriorly by a strongly, broadly arcuate line, broadly, strongly, arcuately emarginate in front, marginal stria complete in front and following contour of emargination.

***Pseudister striatifrons* n. sp.**

(Fig.)

Oblong oval, convex, rufo-piceous, shining; antennae, mouth-parts and legs slightly paler.

Head with the frontal stria distinct, meeting supra-orbital striae at sides, extremely finely, moderately sparsely punctate throughout.

Prothorax one-third wider than long, apical and lateral marginal line fine; apical stria absent, lateral complete, slightly curved at apex; sides feebly arcuate, converging feebly to front; base evenly arcuate; surface finely, sparsely punctate throughout, punctures scarcely denser at sides, base with an irregular row of coarse, closely placed punctures and a small ovate impression in front of scutellum.

Elytra extremely finely, sparsely punctate throughout; striae feebly punctate, with the punctures very feebly crenate, sutural extending from near apex to basal one-third and diverging slightly from suture, second short, present only

on apical one-third, three to six extending from near apex to near base; humeral absent, outer humeral present only on apical one-half; scutellum moderate, equilateral. Propygidium as long as pygidium, moderately coarsely, moderately densely punctate, smoother apically; pygidium extremely finely, sparsely punctate.

Prosternum moderately narrow between striae, striae slightly diverging caudally, nearly parallel anteriorly, not joined in an arch, not quite attaining lobe; mesosternum elevated and limited posteriorly by a straight line, broadly, arcuately emarginate in front, marginal stria present only at sides of emargination, microscopically, sparsely punctate; metasternum microscopically, sparsely punctate. Length, 2 mm.; breadth, 1.1 mm.

Type: In the collection of the writer. Tejupilco, District of Temascaltepec, Mexico, alt., 3960 ft., June, 1933 (H. E. Hinton, R. L. Usinger).

Paratype: One with the same data as above.

Both specimens were collected in the deposits of *Atta sexdens* L. In the paratype the supra-orbital striae do not quite meet in front. It is quite distinct from any of the known American species.

***Pseudister hospes* Lewis.**

Phelister hospes Lewis, Ann. Mag. Nat. Hist. (7), p. 236, 1902.

Phelister hospes Bickhardt, Col. Cat. pt. 24, 30, 1910.

Phelister hospes Casey, Mem. Col. VII, p. 235, 1916.

Phelister hospes Bickhardt, Gen. Insc. Fasc. 166b, p. 211 (note), 218, 1917.

Phelister hospes Leng, Col. Cat. N. A., p. 136, 1920.

Examination of the type of this species shows that the mesosternum is very distinctly emarginate in front. The only difference between certain groups of the genus *Phelister* and *Pseudister* is found in the mesosternum. As stated above, in *Phelister* the front is never emarginate, but is always truncate or bisinuate. A brief characterization of *P. hospes* Lewis follows:

Length, 2 mm. Oblong oval, convex, extremely finely punctate, shining antennae, mouth-parts and legs rufo-piceous. Head with transverse frontal stria deep and distinct, joining supra-orbital striae at sides. Pronotum with apical stria present on middle two-fifths, turned at ends and extending posteriorly for only a short distance; lateral striae not quite attaining base, curved anteriorly and extending across apex to nearly join apical stria. Elytra with humeral stria absent, outer humeral present only on apical one-half, sutural coarse, extending to basal one-third, second extending to basal one-half. Propygidium very coarsely and densely ocellate-punctate, punctures separated mostly by less than their own diameters; pygidium extremely minutely, densely granulate and moderately finely, sparsely punctate. Prosternum between striae wide, from point of end of striae to lobe very narrow, cariniform, striae converging anteriorly; mesosternum shallowly, broadly, arcuately emarginate, marginal stria complete in front.

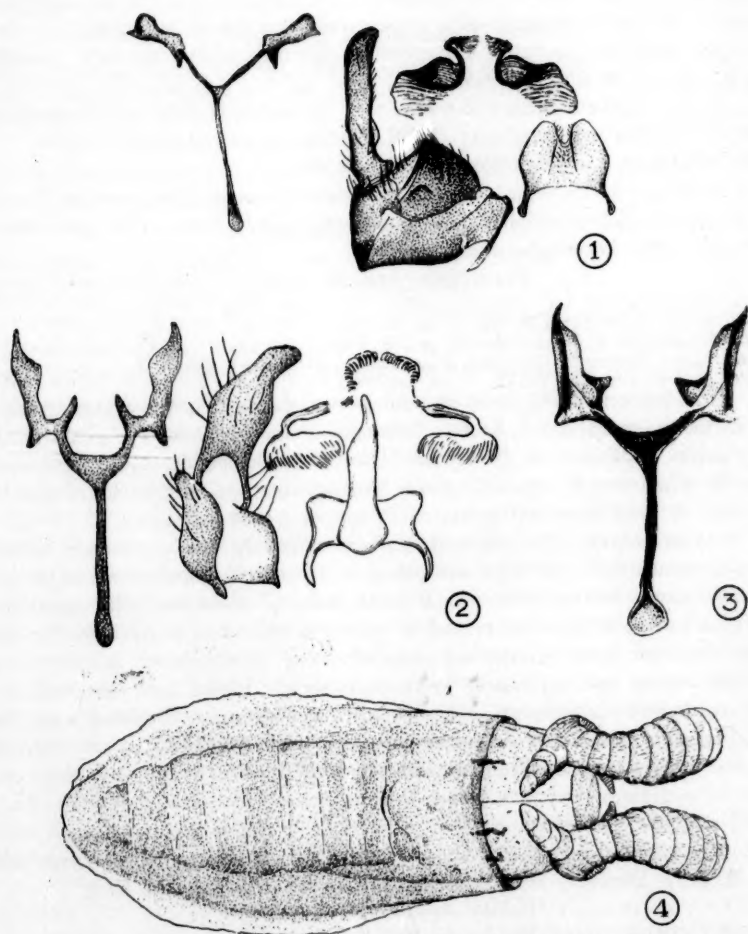
NOTES ON SIMULIUM CANADENSE HEARLE AND SIMULIUM VIRGATUM COQUILLET AND ITS VARIETIES.

BY ERIC HEARLE,*

Dominion Entomological Laboratory, Kamloops, B. C.

In 1929 the writer³ described a British Columbian blackfly pupa with most unusual characteristics—unique among North American species in that the customary slender respiratory filaments are replaced by a closed, ringed, club-like

*Obit. April 17, 1934.



1, female genital fork and male clasper, adminiculum and adminiculum arms of *Simulium canadense* Hearle; 2, the same of *virgatum* Coq. (redrawn from Dyar & Shannon); 3, female genital fork of *S. virgatum rubicundulum* (*chiapanense*) Hoffman (redrawn from Hoffman); 4, dorsal view of pupa of *S. canadense* Hearle. Figures 1, 2 and 3 drawn by Frank Hennessey. 4 by J. D. Gregson.

horn with two short, curved basal spurs. An examination of the literature at our disposal of the pupae known from Europe, Africa, Asia, Australasia and South America, indicates that a number of other unusual forms have been described, especially from Africa. Although the valid species of Simuliidae in the world fauna probably number more than three hundred and fifty, only about twelve of the known pupae of which we have records have breathing organs that are not of the filamentous type. In Northern Europe, *Simulium equinum* L., as described by Edwards² and Puri⁸, has breathing organs consisting of wide, thin-walled tubes, the basal and main branches of which form a ring on the thorax. Puri's⁹ variety *mediterraneum* in Southern Europe is very similar. From Africa, A. W. J. Pomeroy⁷ and B. de Meillon⁶ have described a number of rather bizarre forms. *Simulium blacklocki* Edwards has a basal portion consisting of a large sac and two stout fingerlike tubes projecting from this. The breathing organs of *Simulium unicornutum* Pomeroy and *Simulium palmeri* Pomeroy consist of a single stout, bent tube on each side, in the shape of a "U" in the former and an "L" in the latter, which is further remarkable in that the tube is restricted into a series of globes. *Simulium damnosum* Theobald is slightly less unconventional and is a little like *S. equinum* in that a number of stout tubes replace filaments. One of the most interesting of all known blackfly pupae is *Simulium nodosum*, described by Puri¹⁰ from India. In this the breathing organs are in the form of three dilated clubs with a common base; they are so swollen as to be gourd-like in appearance. We have not access to the more important literature on the Australian and New Zealand species, but A. Tonnoir¹¹ illustrates the pupa of *Simulium* (*Austrosimulium*) *tillyardi* Tonnoir which, together with others of this group, has respiratory filaments in the form of a short, thick stem from which arise a number of simple, slender filaments. A pupa of one of the rarest American Simuliids, recently found by the writer⁴ in British Columbia and Alberta, has some characteristics a little like *Austrosimulium*. Dr. A. Lutz⁸ in his "Simuliidae of Brazil," Part 2, 1910, illustrates what appears to be an unusual form without ordinary filaments (Plate 18, Fig. 1, *Simulium distinctum* Lutz), but the photograph is not sufficiently clear to indicate details. Of the species mentioned above, the pupae of *Simulium nodosum*, *blacklocki* and *equinum* have perhaps the nearest resemblance to the British Columbian *Simulium canadense* and are the most unusual and interesting of the forms so far described.

Adult males and females reared from the British Columbian pupae were at first placed as *Simulium virgatum* Coquillett, and were dealt with by the writer³ as that species. Superficially and in all colour markings, etc., they agree very closely with that species, but unfortunately no dissections of the female fork or male genitalia were made at that time. When these were made later, distinct differences were at once noted from typical *virgatum* and its known varieties and the species is discussed as *Simulium virgatum canadensis* Hearle⁴, and the writer indicates that "the exact status of this form can hardly be decided until the early stages of *virgatum* and *chiapanense* have been found and recorded; for the present it is probably best to consider it as a new race rather than a distinct species." Recently Dr. Bequaert¹ of the Harvard Medical School has discovered and has made rearings from *Simulium virgatum* var. *rubicundulum* (*chiapanense*) in Guatemala and has most kindly compared pupae and adults of

both sexes of our British Columbia species with his Central American specimens. He states that the pupae of *S. virgatum rubicundulum* have respiratory organs of the usual filamentous type and that our form is undoubtedly a distinct species. The correct name, therefore, is now *Simulium canadense* Hearle; the synonymy is *Simulium virgatum* (Hearle) not Coquillett³ and *Simulium virgatum canadensis* Hearle⁴.

Present records indicate that *Simulium canadense* is found only in British Columbia, but its distribution is very widespread in the province, where it is one of the commonest species, being abundant on Vancouver Island and in the mainland coast district as well as throughout the dry interior in the North Thompson and Kamloops districts, Okanagan valley and through the Kootenays in the east of the province. Rather extensive collecting failed to reveal it in Saskatchewan and in Alberta in the Banff and Jasper districts. Our record of a specimen at Jasper³, taken by E. H. Strickland proves to be erroneous. The specimen on which it was based was in a very poor and damaged condition and is *Simulium hunteri* Malloch, a species which we found to be very abundant in our 1931 and 1932 surveys of the blackflies of Jasper National Park. During very extensive collecting at Jasper no *canadense* were found.

The male and female genitalia of *Simulium canadense* have already been described (Hearle³) but the illustrations accompanying these notes will indicate more clearly the differences between this species and *virgatum* and some of varieties.

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A NEW RACE OF ARGYNNIS CYBELE FROM NOVA SCOTIA

BY J. MCDUNNOUGH,
Ottawa, Ont.

Argynnis cybele Fabr. is generally distinguished from the closely allied *A. aphrodite* Fabr. by the following two features: (1) the veins of the central area of the primaries in the male sex are thickened by sex-scales; (2) on the underside of the secondaries the yellow submarginal band is broad and clear and not invaded by the red-brown color of the basal section.

While collecting in Nova Scotia during the months of June and July, 1934, at South Milford and at White Point Beach, near Liverpool, I took a series of an Argynnid which struck me at the time as strongly resembling *aphrodite* on the underside but which on the upperside of the forewings showed the heavy sex-scaling on the veins in the male sex which would consequently indicate *cybele*. No typical *aphrodite* were seen as they probably (if present at all) only appear

*Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

in August. *A. atlantis* Edw. was the only other Argynnid flying at the time and it was easily separated by its heavy dark border and the deep purplish color (not red-brown) of the basal two-thirds of the secondaries.

On studying my series more closely after spreading I found that while one or two specimens of both sexes approached quite closely to *cybele* as it occurs in Quebec and Ontario, the majority showed a *distinct encroachment of red-brown into the yellow submarginal band of the underside of the secondaries*, especially at costa and toward the anal margin, this latter section being at times almost entirely suffused with the red-brown color. The size is rather small, averaging between 55-60 mm. wing expanse for the male and 60-65 mm. for the females. In order to distinguish this interesting race from *aphrodite* I propose the subspecific name *CYBELE NOVASCOTIAE* for it. The types are as follows:

Holotype—♂, White Point Beach, Queens Co., N. S., July 29, (J. McDunnough); No. 3859 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality, July 25.

Paratypes—1 ♂, 9 ♀, same locality, July 18, 24, 25, 28, 29; 10 ♂, S. Milford, N. S., June 30, July 5, 8, 9.

THREE SPECIES OF BEETLES FROM LABRADOR.

BY C. A. FROST,

Framingham, Mass.

In a box of Coleoptera sent me by Mr. C. P. Alexander of the Massachusetts State College for determination I found the following interesting records: *Pachyta liturata* Kby. One specimen bearing the label, "Northwest River, Lab. VIII-15-1929. Coll. F. C. Sears."

Anoplodera hirtella Lec. One specimen with the label, "Northwest River, Lab. Summer of 1933. F. C. Sears Coll." This may be a synonym of *tibialis* Lec.

Cicindela longilabris novaterrae Leng. Four specimens. The two retained by me bear the label, "Sproagdale, Lab. VII-20-1931. F. C. Sears." Two of the specimens were a brilliant green with heavy markings. The green one retained the humeral lunule reduced to two dots, heavy median fascia and an anteapical dot. The other two specimens were of a bronze color with the same heavy markings. The one retained has a complete humeral lunule, with the median fascia somewhat differently formed than the green one and with the anteapical dot having a slight tail posteriorly, making it like a comma reversed.

BOOK NOTICE.

A Manual of Entomological Equipment and Methods. Part I. By Alvah Peterson. With 21 pages, 138 plates, and 12 tables. Lithoprinted by Edwards Brothers, Inc., Ann Arbor, Michigan, 1934. \$3.75.

This volume is designed to serve the working entomologist as an illustrated manual on equipment and as a key to the most useful literature on the subject. Most of the twenty-one pages of text is devoted to a discussion of the field insectary and of the environment within cages and containers. The section on the latter considers the influence on the environment of the various kinds of materials used in the construction of cages. The plates offer outline drawings of equipment together with explanations regarding use and construction and

references to the literature in which the subjects are described. The first four plates deal with insectaries. These are followed by fifty-two plates dealing with cages and containers of various kinds. Twenty-three plates deal with equipment for handling, collecting, and preserving insects, and fourteen deal with traps of various sorts. Five plates illustrate equipment used in behavior studies, and twenty-six are concerned with devices for measuring or controlling environmental factors. Other plates illustrate a great variety of miscellaneous equipment. Most of the tables, which are arranged after the plates, deal with temperature, humidity, and measures. The volume is completed by an index of authors and contributors and a seven-page index of contents.

The author has shown considerable ingenuity in the presentation of his material. The figures are simple and readily understood, although in the case of very complicated equipment, the author refers the reader to published descriptions for details. The method has allowed the presentation of a great amount of material in a relatively small number of pages.

Although presented as Part I, the volume seems complete in itself. The author promises a second part which will consider rearing methods and supplementary material. The present volume has the usual merits of skilfully compiled works and will prove very useful, especially to teachers and to those who work with living insects.—W. J. BROWN.

Mailed Saturday, Feb. 2, 1935.

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